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Frustrated Spin Systems
- Extended critical phenomenon, spin chirality, and transport and optical properties -

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Geometrical frustration is one of the most intriguing problem in the physcis of spin systems. In this talk, I will focus on the two issues.

(i) The analysis of the recent neutron scattering experiments and phase transition in fcc NiS_2 with frustrated exchange interactions. In this system, we could determine the exchange couplings accurately and found that the system in very near to the border of the two AF structures called type I and II, which is also confirmed by LDA+U calculation. This near-degeneracy gives rise to the extended critical region and the spin-Peierls type distortion accompanied by the first order second phase transition. In this case the spin structure is non-collinear (even non-coplanar) possibly due to the 4-spin exchange process, which leads to the spin chirality.

(ii) Quantum transport and optical process is very sensitive to the interference of the quantal phase induced by this spin chirality. We present here the theoretical results on the 2D Kagome lattice [1], 3D pyrochlore lattice, 2D triangular lattice, and 3D fcc lattice with nontrivial spin textures. With the partially filled band, spin chirality based anomalous Hall effect (AHE) appears as is observed in the metallic pyrochlore ferromagnets $R_2Mo_2O_7$ (R =Nd, Sm, Gd). Even in the Mott insulating state and/or AF ordering, the optical Faraday rotation is expected with the ordered spin chirality. NiS_2 and $SrFeO_3$ are aslo discussed from this viewpoint.

[1] K. Ohgushi, S. Murakmai, and N. Nagaosa, Phys. Rev. B**62** R6065 (2000).